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(71) Applicant: **Lenzi, Mauro**
I-56100 Pisa (IT)

(72) Inventor: **Lenzi, Mauro**
I-56100 Pisa (IT)

(74) Representative: **Massari, Marcello**
Studio M. Massari S.r.l.
23, Via Fontanella Borghese
00186 Roma (IT)

(54) Device for automatically removing wrongly oriented elements from a supply line of caps, plugs or generally concave elements

(57) In a capping unit for containers comprising a cap hopper, at least one capper and a line for supplying the caps from the hopper to the capper, a device for automatically ejecting all wrongly oriented caps from the supply line comprising a mechanical sensor for stopping the train of caps along the line, an optical member for detecting the wrongly oriented caps, a mechanical ejector controlled by the optical member that ejects the wrongly oriented cap through an opening formed in the line and closed by a spring-operated lid.

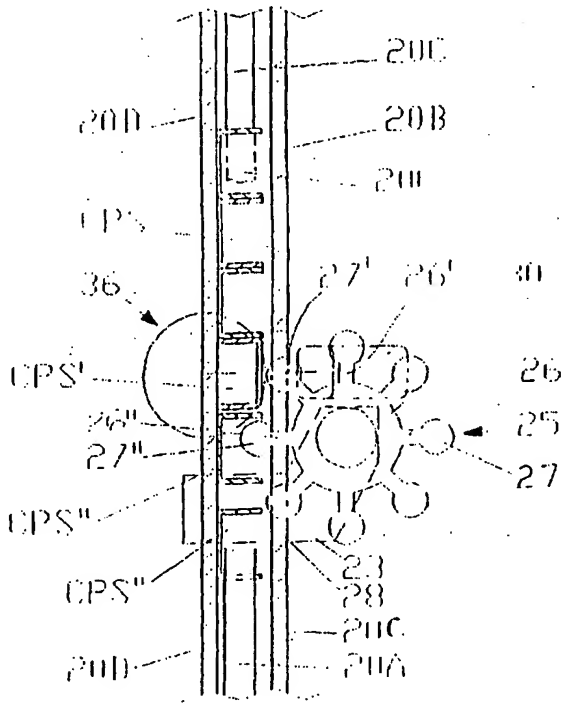

Fig. 2

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Description

This invention refers to a device for automatically removing wrongly oriented elements from a supply line of caps, plugs or generally concave elements.

As known in the art, in drink-bottles capping, cappers utilizing screw-on caps are able to cap thirty thousand to sixty thousand bottles a hour and this requires that five hundred to a thousand caps a minute are supplied thereto.

These speeds are mainly necessary in the industry of drinks such as mineral water, fizzy drinks and the like, where a high daily production is required and a plurality of cappers are used, each comprising a plurality of working heads circularly arranged.

It is evident that each stop of a capper causes a significant production loss and accordingly all factors causing such a stop should be eliminated.

Accordingly, it is essential to avoid that cappers are supplied with wrongly oriented caps, that is caps rotated by 180° with respect to the correct position thereof.

As a matter of fact, a cap reaching a screwing head of a capper in a position rotated by 180° would certainly remain blocked therein causing the capper head to stop and the capper would cyclically release an uncapped bottle. As a consequence the capper should be stopped to remove either the cap or the pieces thereof from the blocked screwing head, thus causing a time waste of 10-20 minutes and a production loss of at least five thousand bottles.

In order to avoid these drawbacks, caps supply systems have been devised provided with elements intended to rightly orient the caps or remove the caps wrongly rotated by 180°. These elements comprise a "trap" opening located at the beginning of the supply line, wherein the caps fall down having the panel or closed portion directed upwardly with respect to the cylindrical flange thereof.

Notwithstanding this, it is always possible that a cap rotated by 180° enters the "train" of caps which are forwarded to the capper in the supply line, both by gravity and air blows.

Since a cap rotated by 180° would cause serious consequences, as mentioned above, at present a sensor is installed in the supply line of the units of this type, which sensor comprises a "window" formed in the supply line and a star wheel idly mounted outside the line and close to the window, which star wheel comprises a plurality of arms.

The length of each arm of the star wheel is such that the end thereof enters the window and is received within the concave portion of the caps as they pass by the window. It is evident that the star wheel is rotated by the caps moving in the line and engaging the arms of the wheel one after the other.

The arrangement is such that, when a cap rotated by 180° reaches the window, the end of the corresponding arm of the star wheel cannot engage the concave portion of the cap but stops against the closed or panel portion thereof, thus stopping also the rotation of the star wheel and the movement of the caps within the line; this causes an acoustic and/or light signal to be emitted.

The alarming signal causes an operator to intervene in order to open a suitable lid that closes a second opening formed in the supply line and remove the wrongly oriented cap. This operation causes at best a stop in the cap supply of 5-6 minutes and a consequent loss in the production.

It is self-evident that while this kind of sensor used at present is effective in signalling any wrongly oriented caps it is not a solution to the problem of time waste and production loss caused by the presence in the supply line of a cap rotated by 180°.

It is an aim of the invention to provide a device intended not only to signal the presence in the supply line of a wrongly oriented cap but also to remove the cap therefrom in a fraction of a second, thus completely eliminating any waste of time.

The device of the invention too comprises a star wheel idly mounted close to a window formed in the supply line, the arms of which engage the concave portion of the caps as they pass by the window; the device of the invention comprises further a light sensor operating an ejector which immediately ejects any wrongly oriented caps from the supply line.

Furthermore, the end of each star wheel arm is paddle shaped to provide a reflecting surface.

The light sensor emits a light beam onto the paddle end of the star wheel which end reflects the beam within the window.

The arrangement is such that, when rightly oriented caps pass by the window, the beam reflected by the paddle is directed outside the cap after a number of reflections; on the contrary, when the wheel arm engages a cap rotated by 180° and stops against the closed or panel portion thereof the reflected beam hits this panel and is immediately reflected a second time returning to the sensible cell of the light sensor.

As the light sensor receives the light beam after the double reflection described above, an electric signal is generated thereby which signal operates the cap ejector. In the preferred form, the cap ejector comprises a double effect pneumatic unit. The position of this unit is such that, when operated, the piston thereof hits the cap which stops the rotation of the star wheel. The cap is ejected through a further opening formed in the wall of the cap supply line located opposite to the opening through which the pneumatic piston hits the cap during the expulsion stroke. This second opening is closed by a spring operated lid that is pushed to open by the cap hit by the pneumatic piston. It is evident that the device of the invention efficiently and quickly solves the problem of removing all the wrongly oriented caps from the cap supply line of a capper.

The invention will be now described in detail with reference to the annexed drawings, wherein:

Figure 1 is a schematical view of a bottle capper system using screw caps, the device of the invention being mounted in the supply line of the capper;
Figure 2 is an axial sectional view of a detail of the length of the supply line wherein the star wheel of the device of the invention is mounted, the wheel being shown frontally and the light sensor being omitted for sake of clarity;
Figure 3 is a similar 90° sectional view of the detail of Figure 2 showing the light sensor, the star wheel being shown in the main plane;
Figure 3B is a transversal sectional view of the supply line close to the light sensor;
Figure 4 is a detail view schematically showing the path of the light beam delivered by the light sensor when the cap is rightly oriented;
Figure 5 shows the path of the same beam when the cap is rotated by 180°.

Figure 1 shows a capping unit for containers, particularly a unit for capping drink bottles of the PET type using screw caps, which unit mainly comprises a hopper 10, a capper 50 and a line 20 supplying capper 50 with caps CPS from hopper 10. Hopper 10, of the rotating plate type, and capper 50, which comprises a plurality of capping heads for screwing caps CPS onto bottles BTL, are known in the art and normally used in such systems and accordingly they will not be shown and described in detail. Cap supply line 20 is also known and normally used to operate with hopper 10 and capper 50 and the same comprises the already mentioned "trap" device 21. This trap 21 is located immediately downstream hopper 10 and causes the caps CPS having the concave portion oriented downwardly to fall into S-shaped pipe 22 wherefrom the same are returned to hopper 10 by a blow of compressed air. It should be said at this point that the caps take the illustrated right position, in which they have the heavier closed or panel portion oriented downwardly, owing to the force of gravity.

Trap 21 and S-shaped pipe 22 are also well known in the art and they will not be further described and illustrated. In the arrangement of the invention caps CPS move to capper 50 along supply line 20, the caps having the open concave portion oriented rightwardly in Figure 1 and the closed or panel portion oriented leftwardly. Furthermore, a star wheel 25, comprising a plurality of arms 26, is mounted on a bracket 23 firmly anchored to length 24 of supply line 20 (Figures 2 and 3), ends 27 of arms 26 being paddle-shaped. Star wheel 25 is mounted on bracket 23 so that, when the same is driven rotating, arms 26 enter window 28 opened in the wall of length 24 of line 20. The arrangement is such that the paddle-shaped end 27 of each arm engages the concave portion of each cap CPS as the same pass by window 28 (Figures 2 and 3) when moving within line 20 in the direction of arrow F1. It is evident that the relationship between each cap CPS and the arm 26 engaging therewith is such that the movement of the caps in the direction of arrow F1 causes idle wheel 25 to rotate in the counterclockwise direction (Figure 2). Furthermore, a second bracket 29 (Figures 4 and 5) supporting a light sensor 30 is mounted on length 24 of line 20. Light sensor 30 is of the kind able to emit and receive a ligh beam. In the construction of the invention light sensor 30 emits a light beam RLM directed to hit paddle 27' of arm 26' which follows arm 26" during the rotation of star wheel 25 (Figures 2, 4 and 5), arm 26" being received within the cap CPS" reaching window 28. It should be noted now that usually line 20 is not a pipe having closed walls but comprises four stainless steel guides 20 (A, B, C, D) (see Figure 3B) placed perpendicular to each other and held together by spaced rings 35 to facilitate, when necessary, the access to the train of caps moving therein. Therefore, the openings or windows such as window 28 are formed either by interrupting or by reducing the guide width.

A double effect pneumatic unit 36 is supported on an appendix 32 of bracket 29, unit 36 being controlled in a known way by solenoid valves (not shown) operated by the electric pulses generated by light sensor 30 whenever beam RLM delivered thereby returns thereto.

The arrangement of pneumatic unit 36 is such that piston 38 thereof in its active stroke is allowed to fit line 20 through a hole 40 formed in guide 20A and facing an opening 41 formed in guide 20C (Figure 3) and having such a size that the caps CPS can easily pass therethrough. Opening 41 is closed by a lid 42 hinged on guide 20C to open outwardly when operated, against the bias of a return spring 43.

With this arrangement the device of the invention works as follows: the train of caps CPS is moved both by gravity and air blows within line 20 from hopper 10 to capper 50, all the caps being oriented as described also owing to the action of trap 21. In this normal and correct situation idle star wheel 25 is caused to rotate by the moving caps that push arms 26", the end 27" of which enters the cap CPS" which has passed by window 28 (Figure 2). It should be noted that beam RLM delivered by light sensor 30 hits a side of paddle 27', is reflected within cap CPS where it is reflected three more times and then hits the other face of paddle 27' to be directed outside window 28 (Figure 4).

However, if a bad operation of hopper 10 or trap 21 causes a cap rotated by 180°, such as cap CPS' of Figure 5, to pass by window 28 the clockwise rotation of star wheel 25 is stopped since end 27' of arm 26' engages the closed or panel portion PPP of cap CPS'.

When wheel 25 is stopped, both cap CPS", that is held by end 27" of arm 26" and all the caps upstream thereof are blocked, while the caps downstream of cap CPS", that is the caps shown in the lower part of Figure 2, continue to move. As shown in Figure 5, the stopping of paddle 27' against the closed or panel portion of cap CPS' causes beam RLM to be reflected both against paddle 27' and against the closed or panel portion PPP of cap CPS' and to return to light sensor 30.

When the reflected beam RLM is received light sensor 30 emits an electric signal that is applied, in a known way, to the solenoid valves of double effect pneumatic unit 36. Accordingly, the piston of unit 36 is pushed into line 20 through hole 40 and violently hits the inverted cap CPS' aligned with hole 40, which cap CPS' causes lid 42 to open against the bias of spring 43 and it is ejected through opening 41.

Then lid 42 closes again and caps CPS continue to move to capper 50. It should be noted now that cap CPS' is removed in a fraction of a second and accordingly no significant stops in the movement of the caps to the capper take place.

It is to be understood that the invention is not limited to the embodiment herein illustrated and described. For example, the double effect pneumatic unit can be replaced by an electromechanical ejector operated by a solenoid controlled by light sensor 30.

Claims

1. In a capping unit for containers comprising a cap hopper, at least one capper and a line for supplying the caps from the hopper to the capper; a device for automatically ejecting all wrongly oriented caps from the supply line comprising: a mechanical sensor controlling the train of caps along the line having an active surface; an optical member for detecting the wrongly oriented caps, provided with elements emitting and receiving a light beam, operating in cooperation with said active surface of said sensor and the reflecting surface offered by the panel portion of each wrongly oriented cap to cause the emitted beam, reflected by said surfaces to return back to said sensor, said optical member being able to emit a control signal when said light beam returns back; and, a mechanical ejector operated by said control signal of said optical member to eject the wrongly oriented cap through a suitable opening.

2. The ejecting device according to claim 1, wherein said mechanical sensor comprises a star wheel, each arm of which has a paddle-shaped end forming said active surface, said star wheel being idly mounted in such a position with respect to said supply line, that said ends entering an opening formed in said supply line engage the moving caps.

3. The ejecting device according to claim 2, wherein said paddle-shaped ends, when engaging the panel portion of a wrongly oriented cap, stop against it along the path of said light beam, said active surface and said panel portion forming the reflecting surfaces sending back to said receiving element the light beam emitted by said emitting element.

4. The ejecting device according to claim 1, wherein said mechanical ejector comprises a double effect pneumatic unit.

5. The ejecting device according to claim 1, wherein said mechanical ejector comprises an electromechanical member operated by a solenoid.

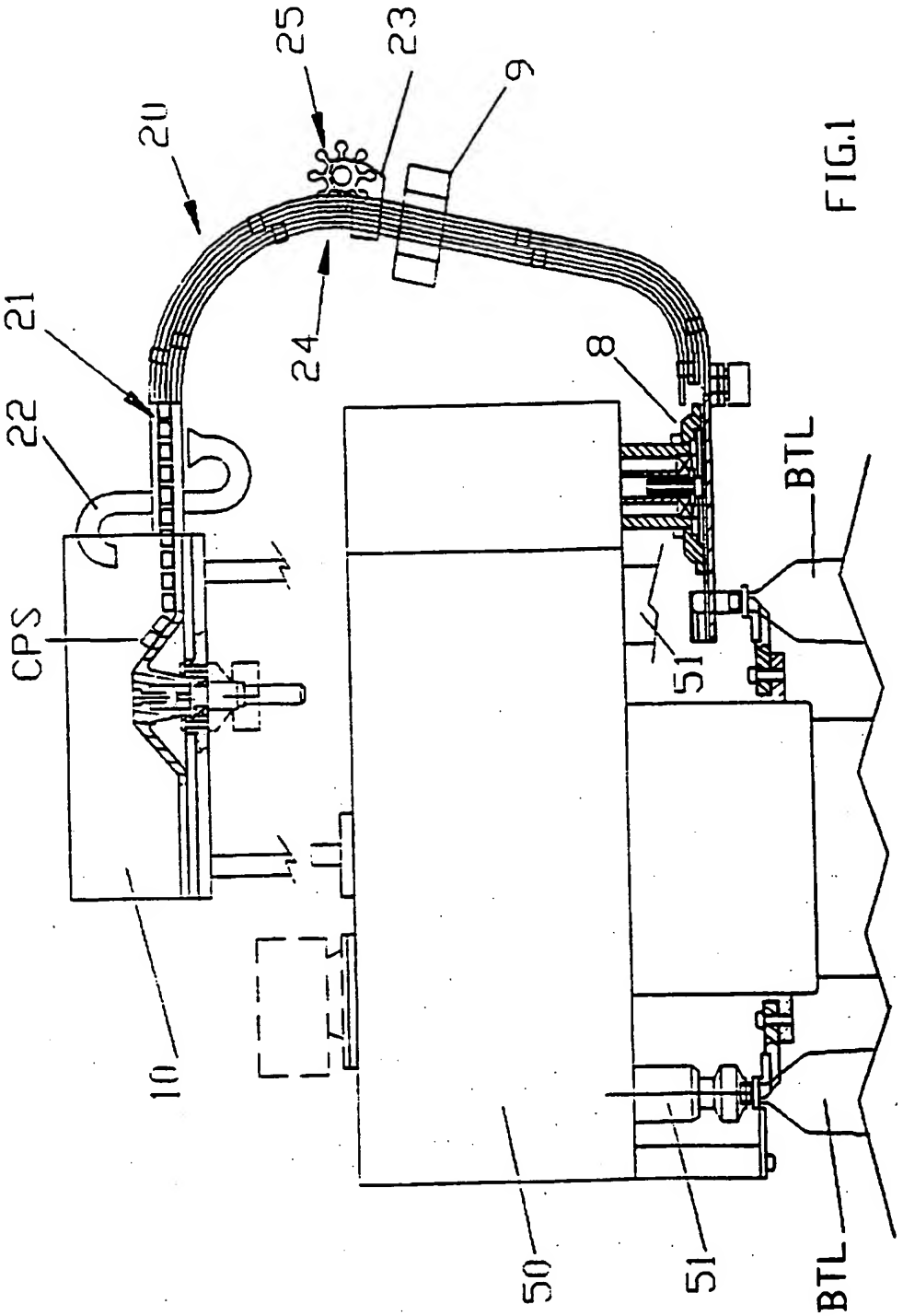


FIG.1

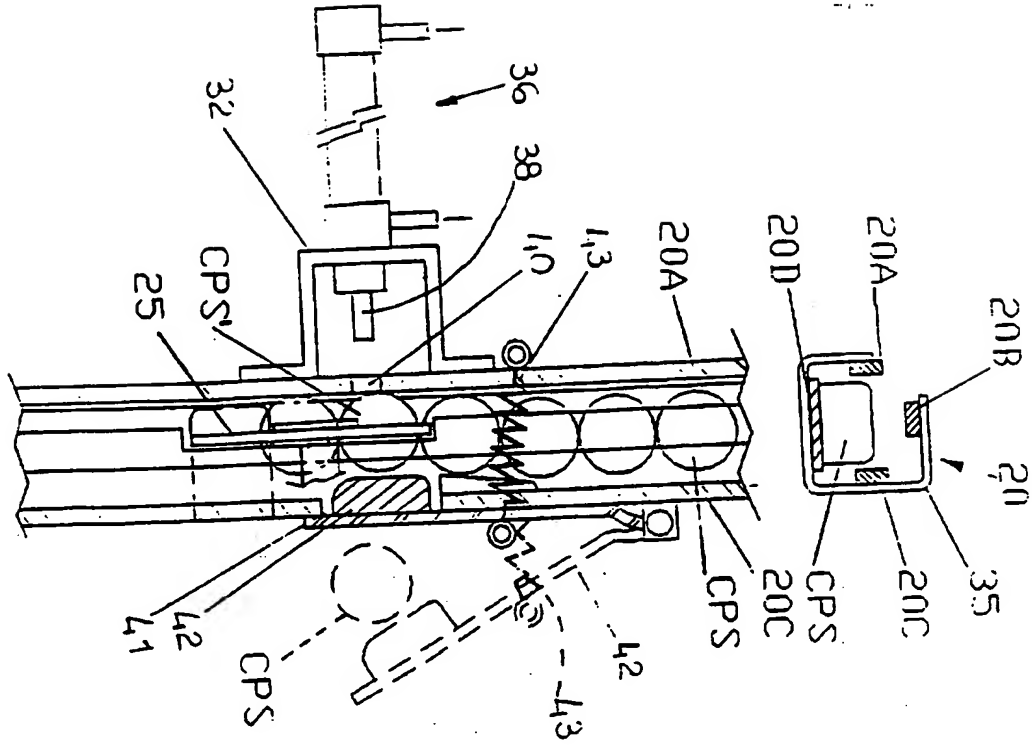
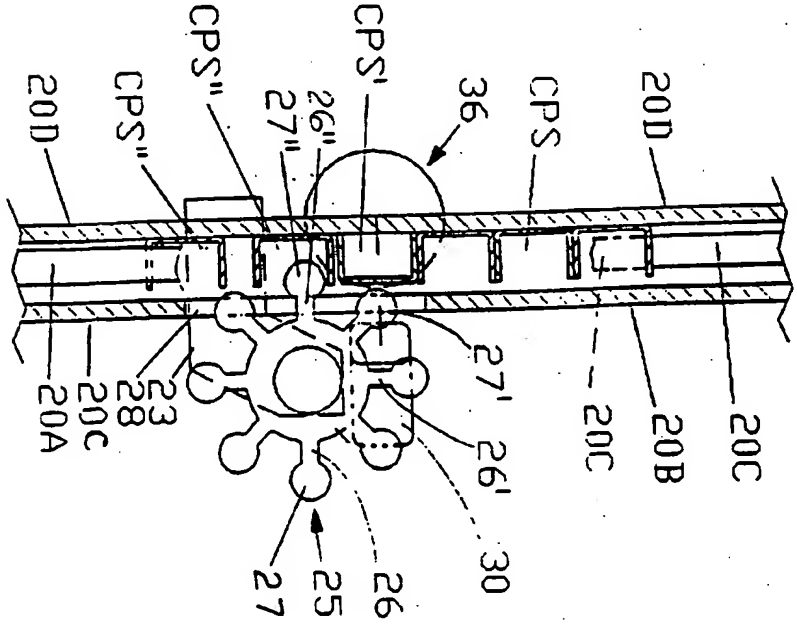

36
32
38
10
13
CPS'
25
20A
20D
20A
20B
21
CPS
20C
CPS
20C
35
42
41
CPS
42
43

FIG.3


CPS"
CPS'
36
CPS
20D
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CPS"
26"
27"
27'
26'
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23
28
20C
20A
20C
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FIG.2

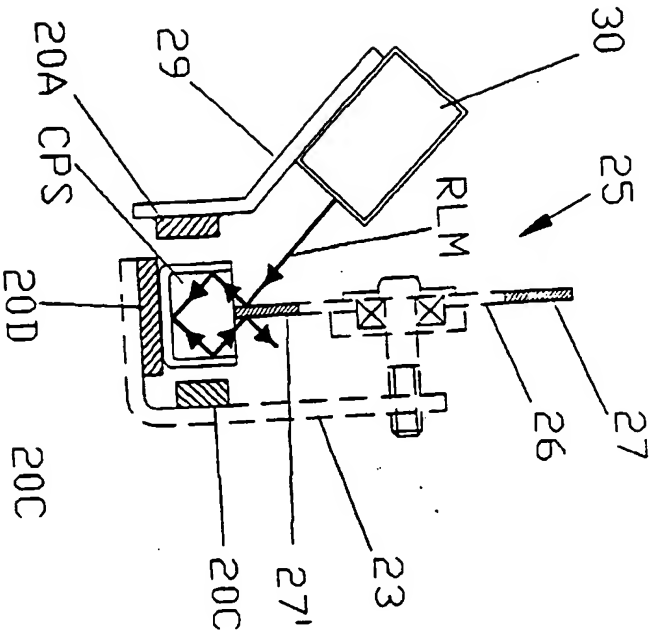
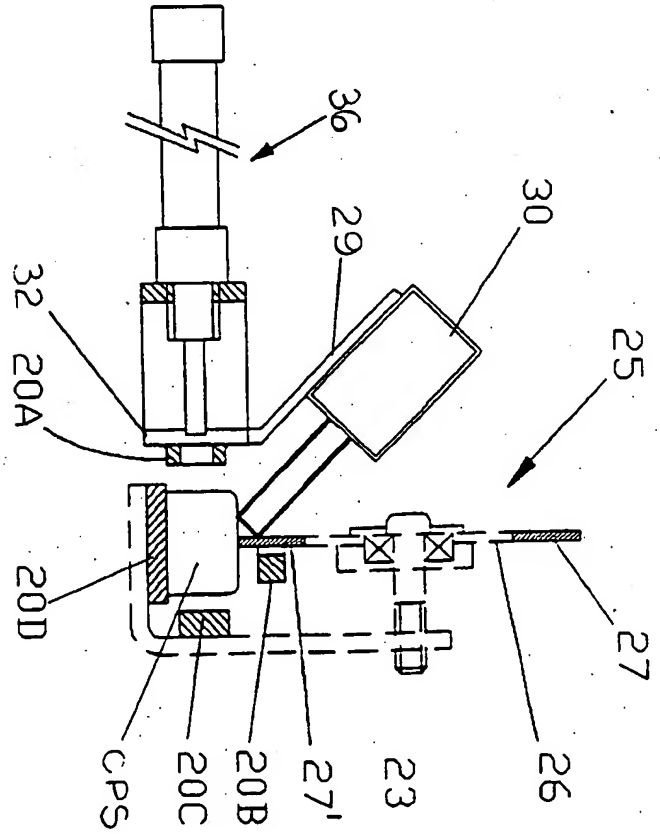

30
29
20A CPS
25
RLM
20D
26
27
20C
27'
23

FIG. 4


36
30
29
32
20A
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20D
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CPS
20C
20B
27'
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FIG. 5